

WEST Search History

DATE: Friday, July 12, 2002

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L16	L15 same l13	19	L16
L15	snmp	1301	L15
L14	l10 same l13	14	L14
L13	ems or (element\$ manag\$ system\$)	15821	L13
L12	L11 and l3	2	L12
L11	l10 same (downstream\$ or (down stream\$))	17	L11
L10	(smnp or cmip or (simple network manag\$ protocol\$) or (common manag\$ information protocol\$)) or ((generic or open or core) near2 (messag\$ or protocol\$ or packet\$))	3522	L10
L9	5905908.pn.	1	L9
L8	6104796.pn.	1	L8
L7	6122363.pn.	1	L7
L6	6260062[pn]	1	L6
L5	6260062[uref]	0	L5
L4	l2 and l3	5	L4
L3	(709/223 OR 709/224 OR 709/220).CCLS.	2022	L3
L2	l1 near8 (manag\$ or monitor\$) near8 (network\$ or lan or internet\$ or intranet\$ or wan)	21	L2
L1	(core or generic\$) near2 (messag\$ or protocol\$)	901	L1

END OF SEARCH HISTORY

WEST Search History

DATE: Friday, July 12, 2002

Set Name Query
side by side

Hit Count Set Name
result set

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L1	(core or generic\$) near2 (messag\$ or protocol\$)	901	L1

END OF SEARCH HISTORY



US006148338A

United States Patent [19][11] **Patent Number:** **6,148,338****Lachelt et al.**[45] **Date of Patent:** **Nov. 14, 2000**

[54] **SYSTEM FOR LOGGING AND ENABLING
ORDERED RETRIEVAL OF MANAGEMENT
EVENTS**

[75] Inventors: **David Jonathan Lachelt; Peter
Thomas Houck**, both of Fort Collins,
Colo.

[73] Assignee: **Hewlett-Packard Company**, Palo Alto,
Calif.

[21] Appl. No.: **09/055,057**

[22] Filed: **Apr. 3, 1998**

[51] Int. Cl.⁷ **G06F 15/173; H05K 10/00**

[52] U.S. Cl. **709/224; 714/47**

[58] Field of Search **709/224; 714/39,
714/47**

[56] **References Cited**

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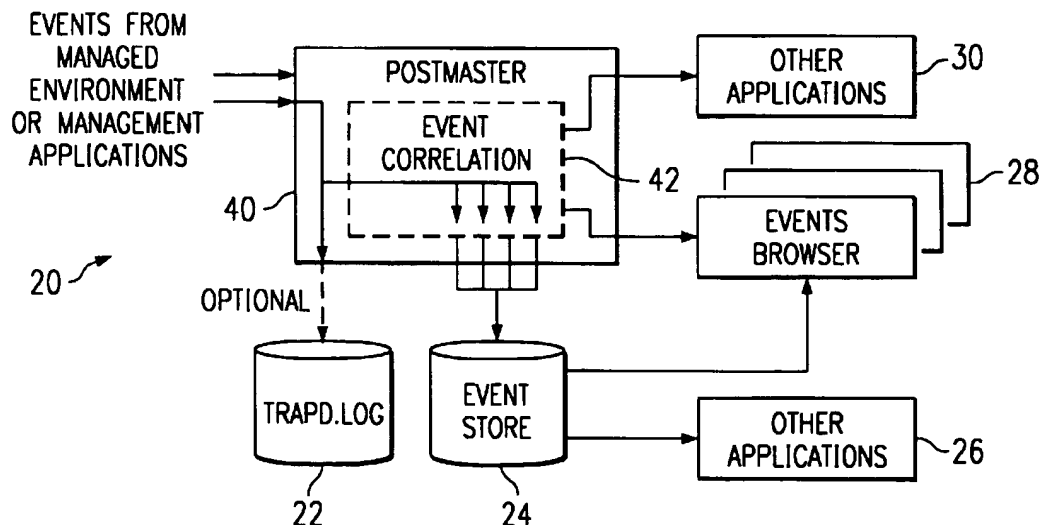
Primary Examiner—Zarni Maung

Assistant Examiner—Andrew Caldwell

[57] **ABSTRACT**

A methodology and supporting structure for logging and ordering management events in a network management system in a managed environment is presented. The network system has a central broker, which monitors the managed environment and receives events in the managed environment, and an event store, which has non-textual files organized into sets with each set containing corresponding event log and event index files. Events are logged as received by the central broker into the non-textual files organized into the sets. A complete representation of one or more events is stored in a language-independent form in an event log file of the event store so that the event information may be read and formatted for presentation in a local language. An event index file of the event log contains the location of the one or more events. The flow from multiple streams of related events may also be tracked.

26 Claims, 4 Drawing Sheets



WEST

Generate Collection

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L4: Entry 2 of 5

File: USPT

Nov 14, 2000

DOCUMENT-IDENTIFIER: US 6148338 A

TITLE: System for logging and enabling ordered retrieval of management events

Brief Summary Paragraph Right (2):

The Simple Network Management Protocol (SNMP) and Common Management Information Protocol (CMIP) are network management protocols that provide a generic mechanism by which different manufacturers' equipment can be monitored and controlled from a management system, such as a UNIX server. A network component on a managed network can be monitored and controlled using a management protocol to communicate management information between network components on the network. A network component includes networked personal computers, workstations, servers, routers, and bridges. There exist several key areas of network management including fault management, configuration management, security management, performance management, and accounting management. With the ability to instruct a network component to report events and the ability to start processes on a network component, the network can be manipulated to suit changing conditions within a system.

Current US Original Classification (1):709/224



US006054987A

United States Patent [19]
Richardson

[11] **Patent Number:** **6,054,987**
 [45] **Date of Patent:** **Apr. 25, 2000**

[54] **METHOD OF DYNAMICALLY CREATING
 NODAL VIEWS OF A MANAGED NETWORK**

[75] Inventor: **David E. Richardson**, Fort Collins,
 Colo.

[73] Assignee: **Hewlett-Packard Company**, Palo Alto,
 Calif.

[21] Appl. No.: **09/087,338**

[22] Filed: **May 29, 1998**

[51] Int. Cl.⁷ **G06F 3/14**

[52] U.S. Cl. **345/348; 345/440; 345/356;
 345/352; 345/349; 345/969; 709/223; 709/224**

[58] Field of Search **345/969, 357,
 345/349, 356, 440, 348, 968, 352; 709/223,
 224, 226**

[56] **References Cited**

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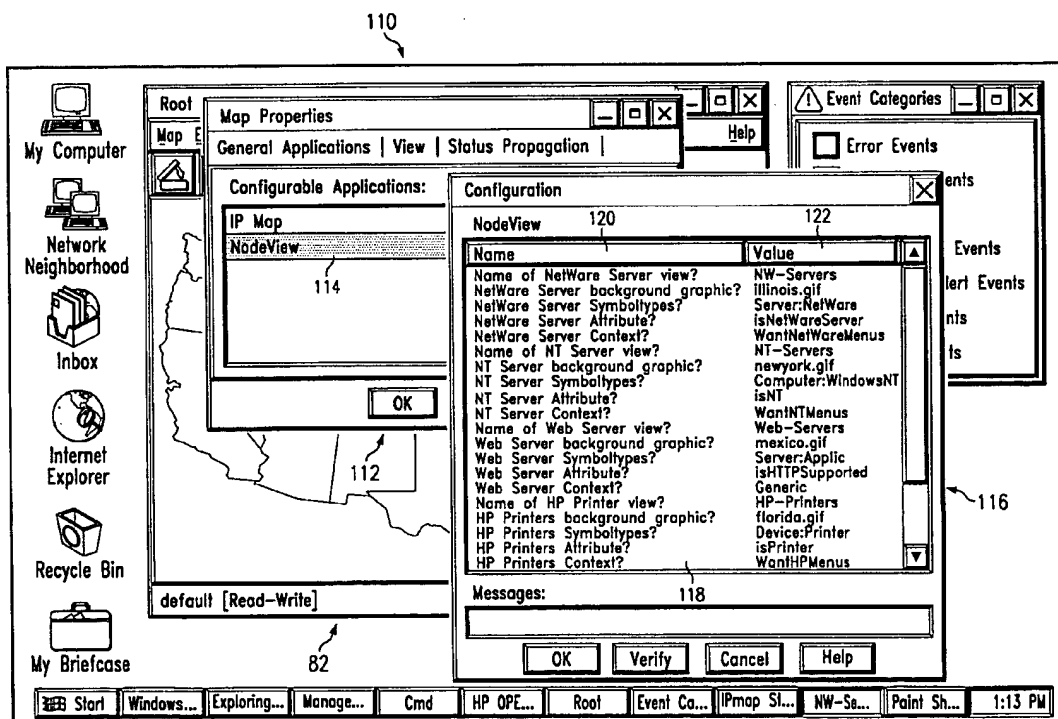
Primary Examiner—Raymond J. Bayerl

Assistant Examiner—Thomas T. Nguyen

[57] **ABSTRACT**

A methodology for dynamically creating, modifying, and deleting nodal views of a managed network environment is presented. The methodology stores the group view information in a file that may be edited by a user. This allows the user to be able to dynamically configure group view information. The methodology also provides menubars, popup menus, and toolbar that are context sensitive to the group view that is selected.

15 Claims, 5 Drawing Sheets



WEST

Generate Collection

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L4: Entry 4 of 5

File: USPT

Apr 25, 2000

DOCUMENT-IDENTIFIER: US 6054987 A

TITLE: Method of dynamically creating nodal views of a managed network

Brief Summary Paragraph Right (2):

The Simple Network Management Protocol (SNMP) and Common Management Information Protocol (CMIP) are network management protocols that provide a generic mechanism by which different manufacturers' equipment can be monitored and controlled from a management system, such as a UNIX server. A network component on a managed network can be monitored and controlled using a management protocol to communicate management information between network components on the network. A network component includes networked personal computers, workstations, servers, routers, and bridges. There exist several key areas of network management including fault management, configuration management, security management, performance management, and accounting management. With the ability to instruct a network component to report events and the ability to start processes on a network component, the network can be manipulated to suit changing conditions within a system.

Current US Cross Reference Classification (4):709/223Current US Cross Reference Classification (5):709/224



US006195349B1

(12) **United States Patent**
Hiscock et al.

(10) **Patent No.: US 6,195,349 B1**
 (45) **Date of Patent: Feb. 27, 2001**

(54) **SCALABLE LOGICAL LAN**

(75) **Inventors:** James Scott Hiscock, Rockport; Joris Johannes Maria Wils, Acton, both of MA (US); Michael John Seaman, Mountain View, CA (US); Edward A. Heiner, Jr., Londonderry, NH (US); G. Stodel Friedman, Acton; John Joseph Harrison, Jr., North Grafton, both of MA (US)

(73) **Assignee:** 3COM Corporation, Santa Clara, CA (US)

(*) **Notice:** Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) **Appl. No.:** 09/014,547

(22) **Filed:** Jan. 28, 1998

(51) **Int. Cl.⁷** H04L 12/50; H04L 1/00

(52) **U.S. Cl.** 370/360; 370/255; 370/400

(58) **Field of Search** 370/360, 355, 370/356, 254, 255, 400, 401, 402, 252, 253, 466, 467, 409, 397, 399, 465, 431, 433, 437, 256, 392, 389, 396, 398, 406; 709/238, 239, 224

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Primary Examiner—Wellington Chin

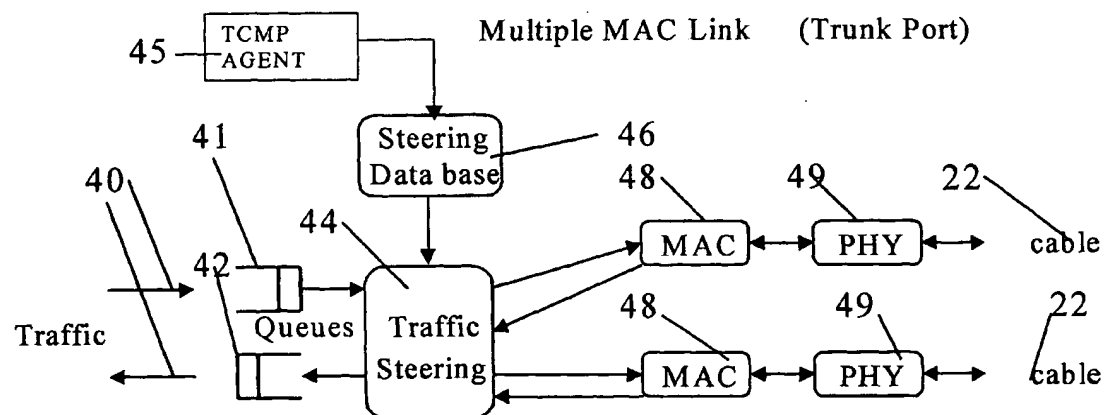
Assistant Examiner—Steven Nguyen

(74) *Attorney, Agent, or Firm*—McGlew and Tuttle, P.C.

(57) **ABSTRACT**

A packet based high speed mesh forms a trunk cluster. The trunk cluster is constructed with a set of loosely coupled switches, a configuration protocol, trunked network interfaces, and optionally a reachability protocol. The trunk cluster provides a Logical LAN service. Each switch in the trunk cluster provides a single "shared LAN" by interconnecting two or more links. The edge devices attached to the links run a trunk configuration protocol. These attached edge devices view the trunked ports as if trunked ports are connected to a shared LAN with multiple other attached devices.

10 Claims, 4 Drawing Sheets



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L2: Entry 6 of 21

File: USPT

Feb 27, 2001

DOCUMENT-IDENTIFIER: US 6195349 B1

TITLE: Scalable logical LAN

Brief Summary Paragraph Right (11):

As each trunk switch only carries part of the traffic between edge devices, each trunk switch does not need to and must not participate in any topology control or discovery protocol. Spanning tree, TCMP (Trunk Cluster Management Protocol), IGMP (Internet Group Management Protocol), and GARP (Generic Attribute Registration Protocol) packets are flooded. Unicast MAC (Media Access Controller) source addresses are learned and used to intelligently forward/filter unicast packets to minimize flooding within the "shared LAN" and increase throughput. The maximum throughput of the trunk cluster increases with each additional trunk switch.

WEST Search History

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L16	L15 same l13	19	L16
L15	snmp	1301	L15
L14	l10 same l13	14	L14
L13	ems or (element\$ manag\$ system\$)	15821	L13
L12	L11 and l3	2	L12
L11	l10 same (downstream\$ or (down stream\$))	17	L11
L10	(snmp or cmip or (simple network manag\$ protocol\$) or (common manag\$ information protocol\$)) or ((generic or open or core) near2 (messag\$ or protocol\$ or packet\$))	3522	L10
L9	5905908.pn.	1	L9
L8	6104796.pn.	1	L8
L7	6122363.pn.	1	L7
L6	6260062[pn]	1	L6
L5	6260062[uref]	0	L5
L4	l2 and l3	5	L4
L3	(709/223 OR 709/224 OR 709/220).CCLS.	2022	L3
L2	l1 near8 (manag\$ or monitor\$) near8 (network\$ or lan or internet\$ or intranet\$ or wan)	21	L2
L1	(core or generic\$) near2 (messag\$ or protocol\$)	901	L1

END OF SEARCH HISTORY



US006047279A

United States Patent [19][11] **Patent Number:** **6,047,279****Barrack et al.**[45] **Date of Patent:** **Apr. 4, 2000**

[54] **SYSTEM AND METHOD FOR AUTOMATIC
NETWORK MANAGEMENT SUPPORT
USING ARTIFICIAL INTELLIGENCE**

[75] Inventors: **Martin Barrack**, Folsom; **Andrew H. Lee**, El Dorado Hills, both of Calif.

[73] Assignee: **Objective Systems Integrators, Inc.**,
Folsom, Calif.

[21] Appl. No.: **08/971,528**

[22] Filed: **Nov. 17, 1997**

[51] Int. Cl.⁷ **G06F 17/00**

[52] U.S. Cl. **706/60; 706/61; 706/62**

[58] Field of Search **706/60, 45, 908,
706/917, 61, 62; 702/186**

[56] **References Cited**

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Primary Examiner—Eric W. Stamber

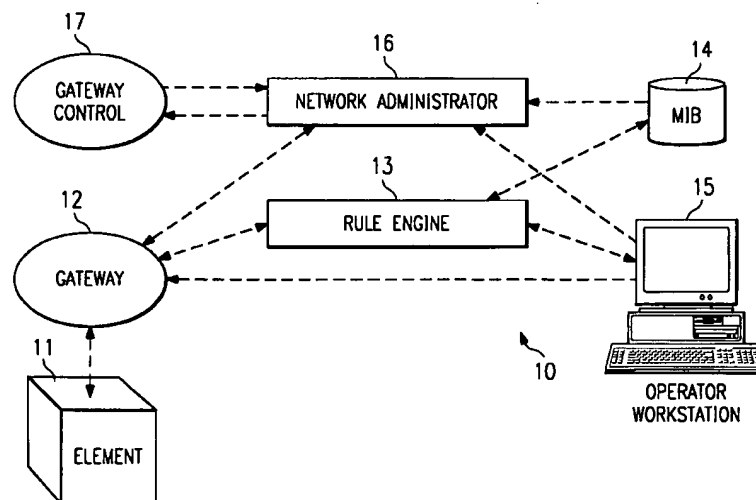
Assistant Examiner—Anil Khatri

Attorney, Agent, or Firm—Fulbright & Jaworski L.L.P.

[57] **ABSTRACT**

The inventive system and method incorporates artificial intelligence concepts to create a system that automatically integrates new network elements. The system detects the connection of the new element with the system. The system identifies the new element, either directly or inferentially, by examining the protocol, the inputs, and the outputs of the new element, as compared with stored information. The inventive system then either selects the appropriate rule set from previously written rules, modifies an existing rule set from similar elements, or creates an appropriate rule set to integrate each new element into the network. The rule set produced by the system is then used to manage the new element.

60 Claims, 1 Drawing Sheet



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L14: Entry 11 of 14

File: USPT

Apr 4, 2000

DOCUMENT-IDENTIFIER: US 6047279 A

TITLE: System and method for automatic network management support using artificial intelligence

Brief Summary Paragraph Right (10):

FIG. 1 depicts a schematic diagram of the prior NetExpert system 10. NetExpert is based on the Telecommunication Management Network (TMN) standards promulgated by the International Telecommunications Union. It supports the development and deployment of applications for the main TMN areas, i.e. fault, configuration, performance, accounting, and security. The NetExpert framework 10 has been designed to manage external systems that include network elements, network element management systems, legacy support systems, CMIP protocol controlled agents/managers, Simple Network Management Protocol ("SNMP") agents/managers, user applications, databases, and personnel. All of these elements 11 are objects that can be managed by the system, and the system can be used to provide functionality at each level of the TMN business model, element management, network management service management and business management levels.

L14: Entry 11 of 14

File: USPT

Apr 4, 2000

DOCUMENT-IDENTIFIER: US 6047279 A

TITLE: System and method for automatic network management support using artificial intelligence

Brief Summary Paragraph Right (10):

FIG. 1 depicts a schematic diagram of the prior NetExpert system 10. NetExpert is based on the Telecommunication Management Network (TMN) standards promulgated by the International Telecommunications Union. It supports the development and deployment of applications for the main TMN areas, i.e. fault, configuration, performance, accounting, and security. The NetExpert framework 10 has been designed to manage external systems that include network elements, network element management systems, legacy support systems, CMIP protocol controlled agents/managers, Simple Network Management Protocol ("SNMP") agents/managers, user applications, databases, and personnel. All of these elements 11 are objects that can be managed by the system, and the system can be used to provide functionality at each level of the TMN business model, element management, network management service management and business management levels.



US006115393A

United States Patent [19]

Engel et al.

[11] **Patent Number:** 6,115,393[45] **Date of Patent:** Sep. 5, 2000[54] **NETWORK MONITORING**

[75] Inventors: **Ferdinand Engel**, Northborough;
Kendall S. Jones, Newton Center;
Kary Robertson, Bedford, all of Mass.;
David M. Thompson, Redmond,
 Wash.; **Gerard White**, Tyngsborough,
 Mass.

[73] Assignee: **Concord Communications, Inc.**,
 Marlboro, Mass.

[21] Appl. No.: **08/505,083**[22] Filed: **Jul. 21, 1995****Related U.S. Application Data**

[60] Division of application No. 07/761,269, Sep. 17, 1991,
 abandoned, which is a continuation-in-part of application
 No. 07/684,695, Apr. 12, 1991, abandoned.

[51] Int. Cl.⁷ **H04J 3/16; H04J 3/22**[52] U.S. Cl. **370/469**

[58] **Field of Search** 370/94.1, 85.13,
 370/85.14, 94.2, 110.1, 79, 241, 252, 254,
 465, 464, 466, 467, 469; 395/200, 183.15,
 189.01, 189.04, 200.54, 285, 831; 371/20.1

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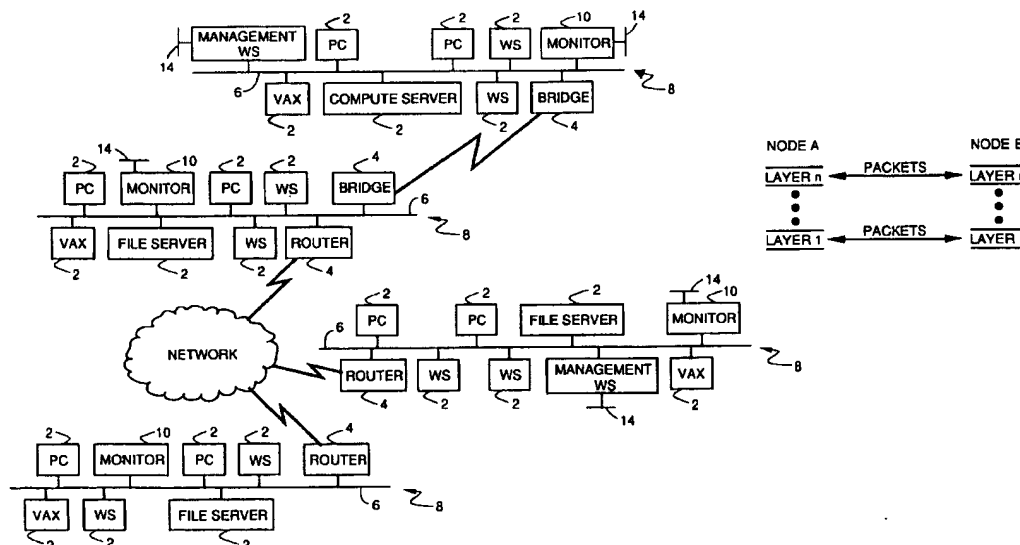
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Primary Examiner—Ajit Patel

Attorney, Agent, or Firm—Fish & Richardson P.C.

[57] **ABSTRACT**

Monitoring is done of communications which occur in a
 network of nodes, each communication being effected by a
 transmission of one or more packets among two or more
 communicating nodes, each communication complying with
 a predefined communication protocol selected from among
 protocols available in the network. The contents of packets
 are detected passively and in real time, communication
 information associated with multiple protocols is derived
from the packet contents.

25 Claims, 38 Drawing Sheets

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L17: Entry 8 of 10

File: USPT

Sep 5, 2000

DOCUMENT-IDENTIFIER: US 6115393 A

TITLE: Network monitoring

Detailed Description Paragraph Right (33):

Among the major modules which make up Monitor 10 is a real time kernel 20, a boot/load module 22, a driver 24, a test module 26, an SNMP Agent 28, a Timer module 30, a real time parser (RTP) 32, a Message Transport Module (MTM) 34, a statistics database (STATS) 36, an Event Manager (EM) 38, an Event Timing Module (ETM) 40 and a control module 42. Each of these will now be described in greater detail.

Detailed Description Paragraph Right (49):

Event Manager (EM) 38 extracts statistics from STATS and formats it in ways that allow the Workstation to understand it. It also examines the various statistics to see if their behavior warrants a notification to the Management Workstation. If so, it uses the SNMP Agent software to initiate such notifications.



US005999179A

United States Patent [19]
Kekic et al.

[11] Patent Number: 5,999,179
[45] Date of Patent: Dec. 7, 1999

[54] **PLATFORM INDEPENDENT COMPUTER
NETWORK MANAGEMENT CLIENT**

[75] Inventors: Miodrag M. Kekic, Mountain View;
Grace N. Lu, Milpitas; Eloise H.
Carlton, San Carlos, all of Calif.

[73] Assignee: Fujitsu Limited, Kawasaki, Japan

[21] Appl. No.: 08/972,091

[22] Filed: Nov. 17, 1997

[51] Int. Cl.⁶ G06F 3/00

[52] U.S. Cl. 345/349; 345/969; 345/970;
345/357

[58] Field of Search 345/349, 350,
345/969, 970, 348, 357

[56] **References Cited**

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Primary Examiner—Mark K. Zimmerman

Assistant Examiner—David E. Brown

Attorney, Agent, or Firm—Skjerven, Morrill, MacPherson,
Franklin & Friel LLP, Edward C. Kwok

[57] **ABSTRACT**

A client-server network management system includes: a plurality of managed computer network elements, a managed element server that executes on a first computer, and at least one managed element server client that typically

executes on a second computer. The managed element server and managed element server client are computer processes that execute from memory of their respective computers. The client-server network management system is really two applications in one: a visual element manager builder and a manager. The manager provides the run-time environment in which element managers are executed to monitor and manage computer network behavior such as network throughput, collision rate, and number of duplicate IP packets, to name a few. The manager portion of managed element server is independent of any graphic user interface. The logic and structure of the manager of managed element server is cleanly separated from the graphic user interfaces. The visual element manager builder is a visual development environment in which device vendors or network managers may create standardized element management applications, called element managers. A user can build an element manager without writing a any computer code. In addition, a user can edit an element manager without writing any computer code. A graphic user interface of this invention, that is displayed by the client, includes a visual image of a computer network element being managed. As a user looks at the visual display in the graphic user interface, the user is provided the same visual information as if the user were physically present at the location of the managed computer network element. Thus, at a glance, a user can obtain considerable information about the status of the computer network element as represented by the visual display.

12 Claims, 57 Drawing Sheets

Microfiche Appendix Included
(6 Microfiche, 279 Pages)

JUMBO

Applet Viewer: netprism.client.NetPrism.class 311

NetPrism 311A Critical 311B Warning 311C Unknown 311D Disabled 311E 311F

Logout 312A Alarms 312B MIB Browser 312C Help 312D

FUJITSU POWER 10BASE-T 10BASE2 AUI 377 INPUT 100-120V 378

a_hotspot 3 4 5 6 7 8 9 10 11 12 13 14 15 16

NetPrism@happy

☑ Element Managers

☑ Managed Elements

☑ All Elements

☑ Netscape Server@www.netprism.

☑ Sun_Workstation@192.240.6.27

☑ SNMP_Manager@hub

305

Status of a hotspot

State: Normal View By: Attribute Name

Attribute Name	Event Name	Polling	Value	Description
sysDescr	Once_300_sec	On	F9190HA16 Agent Hub A11.8.1992	A textual description of
sysName	Once_300_sec	On	Desperado	"An administratively-ass
sysUpTime	Once_300_sec	On	5 hours, 45minutes, 23 seconds.	"The time(inhundredths
sysContact	Once_300_sec	On	UTV	"The textualidentificatio

Graph Value Update All Values(s) Edit Value..

Update Complete.

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L17: Entry 9 of 10

File: USPT

Dec 7, 1999

DOCUMENT-IDENTIFIER: US 5999179 A

TITLE: Platform independent computer network management client

Detailed Description Paragraph Right (209):

When the discovery process is complete, all discovered SNMP-enabled computer network elements are displayed in navigation tree 305. If managed element server 314 was able to associate a discovered computer network element with an element manager (EM), navigation tree 305 has a node under managed elements with a node name with the format "<EM Name>@". The managed element can be edited and monitored by server 314 based on the definition of components. If no association can be made, the node name has the format "@". In this embodiment, computer network elements located behind a firewall cannot be discovered.



US006272537B1

(12) **United States Patent**
Kekic et al.

(10) **Patent No.:** US 6,272,537 B1
(45) **Date of Patent:** Aug. 7, 2001

(54) **METHOD FOR BUILDING ELEMENT
MANAGER FOR A COMPUTER NETWORK
ELEMENT USING A VISUAL ELEMENT
MANAGER BUILDER PROCESS**

(75) Inventors: **Miodrag M. Kekic**, Mountain View;
Grace N. Lu, Milpitas; **Eloise H.
Carlton**, San Carlos, all of CA (US)

(73) Assignee: **Fujitsu Limited**, Kawasaki (JP)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 0 days.

(21) Appl. No.: **08/972,092**

(22) Filed: **Nov. 17, 1997**

(51) Int. Cl.⁷ **G06F 13/00**

(52) U.S. Cl. **709/223; 709/203; 709/219;
709/329**

(58) Field of Search **709/201, 202,
709/203, 205, 206, 217, 218, 219, 220,
223, 221, 313, 328, 329; 707/10, 104**

(56) **References Cited**

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5,848,246	*	12/1998	Gish	709/228
5,870,558	*	2/1999	Branton, Jr. et al.	709/224
5,909,545	*	6/1999	Frese, II et al.	709/208

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Primary Examiner—Viet D. Vu

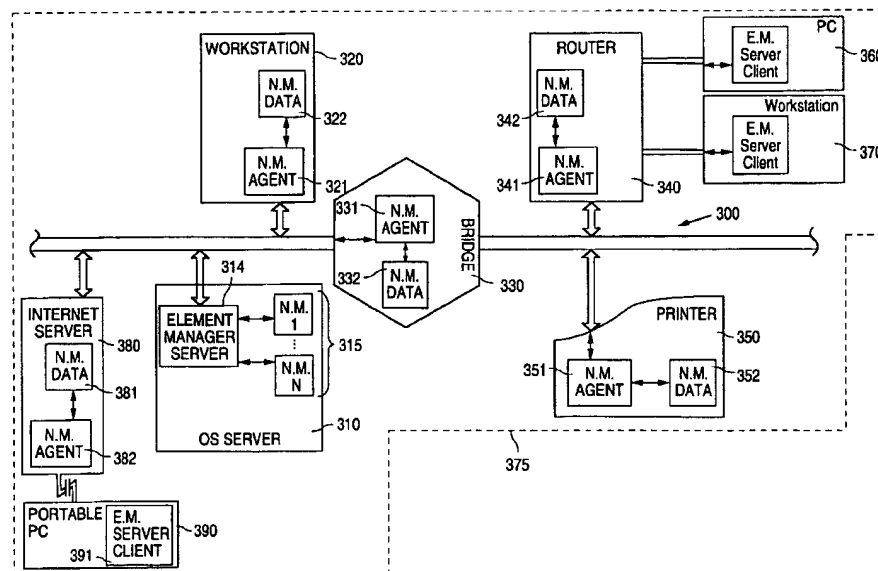
(74) Attorney, Agent, or Firm—Skjerven Morrill

MacPherson LLP; Edward C. Kwok

(57) **ABSTRACT**

A client-server network management system includes: a plurality of managed computer network elements, a managed element server that executes on a first computer; and at least one managed element server client that typically executes on a second computer. The managed element server and managed element server client are computer processes that execute from memory of their respective computers. The client-server network management system is really two applications in one: a visual element manager builder and a manager. The manager provides the run-time environment in which element managers are executed to monitor and manage computer network behavior such as network throughput, collision rate, and number of duplicate IP packets, to name a few. The manager portion of managed element server is independent of any graphic user interface. The logic and structure of the manager of managed element server is cleanly separated from the graphic user interfaces. The visual element manager builder is a visual development environment in which device vendors or network managers may create standardized element management applications, called element managers. A user can build an element manager without writing a any computer code. In addition, a user can edit an element manager without writing any computer code. A graphic user interface of this invention, that is displayed by the client, includes a visual image of a computer network element being managed. As a user looks at the visual display in the graphic user interface, the user is provided the same visual information as if the user were physically present at the location of the managed computer network element. Thus, at a glance, a user can obtain considerable information about the status of the computer network element as represented by the visual display.

26 Claims, 50 Drawing Sheets



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L17: Entry 6 of 10

File: USPT

Aug 7, 2001

DOCUMENT-IDENTIFIER: US 6272537 B1

TITLE: Method for building element manager for a computer network element using a visual element manager builder process

Detailed Description Paragraph Right (200):

When the discovery process is complete, all discovered SNMP-enabled computer network elements are displayed in navigation tree 305. If managed element server 314 was able to associate a discovered computer network element with an element manager (EM), navigation tree 305 has a node under managed elements with a node name with the format "<EM Name>@". The managed element can be edited and monitored by server 314 based on the definition of components. If no association can be made, the node name has the format "@". In this embodiment, computer network elements located behind a firewall cannot be discovered.



US006400713B1

(12) **United States Patent**
Thomas et al.

(10) **Patent No.:** **US 6,400,713 B1**
(45) **Date of Patent:** **Jun. 4, 2002**

(54) **INTEGRATED ELEMENT MANAGER AND
INTEGRATED MULTI-SERVICES ACCESS
PLATFORM**

(75) Inventors: **Shaji A. Thomas, McKinney; Paul R. Frazier, Dallas; David E. Austin; Andrew M. Walding, both of Plano; Clemente G. Garcia, Garland, all of TX (US)**

(73) Assignee: **Alcatel USA Sourcing, L.P., Plano, TX (US)**

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/342,740**

(22) Filed: **Jun. 29, 1999**

Related U.S. Application Data

(60) Provisional application No. 60/091,370, filed on Jun. 30, 1998.

(51) Int. Cl.⁷ **H04L 12/66; H04M 17/00**

(52) U.S. Cl. **370/355; 370/386; 379/219; 709/229; 709/249**

(58) Field of Search **370/466, 468, 370/467, 355, 523; 379/221, 34, 219; 709/227, 223, 200, 249, 229**

(56) **References Cited**

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Cranfill N.K. et al., "Emerging Technologies for the Control of the Defense Red Switch Network (DRSN)", Proceedings of the Military Communications Conference (MILCOM), Long Beach, NJ., Oct. 2-5, 1994, vol. 2, pp. 664-668.

(List continued on next page.)

Primary Examiner—Ajit Patel

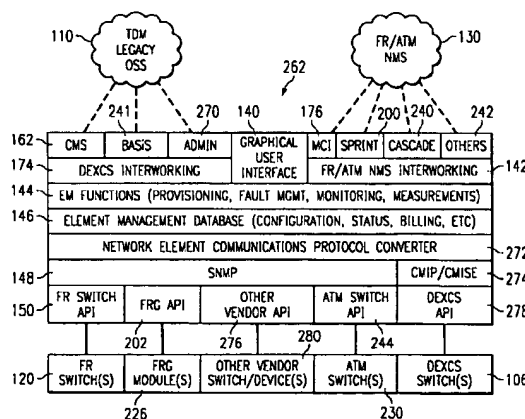
Assistant Examiner—John Pezzlo

(74) *Attorney, Agent, or Firm*—Baker Botts L.L.P.

(57) **ABSTRACT**

An integrated multi-services access platform includes a time division multiplex interface coupled to a time division multiplex network, a matrix in communications with the time division multiplex interface, a frame relay groomer coupled to the matrix, an asynchronous transfer mode matrix coupled to the frame relay groomer, and an asynchronous transfer mode interface coupled to a frame relay/asynchronous transfer mode network. The integrated multi-services access platform may further include an integrated element manager, which includes a centralized management system coupled to a time division multiplex operational support system, a frame relay/asynchronous transfer mode network management system interworking unit coupled to at least one frame relay/asynchronous transfer mode network management system, an element management function unit operable for service provisioning, fault management, element and network monitoring, and metric measurements, an element management database having service and network configurations, status, and billing information, a simple network management protocol unit, and at least one application program interface coupled to at least one telecommunications element.

22 Claims, 6 Drawing Sheets



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L14: Entry 1 of 14

File: USPT

Jun 4, 2002

DOCUMENT-IDENTIFIER: US 6400713 B1

TITLE: Integrated element manager and integrated multi-services access platform

Detailed Description Paragraph Right (8):

Frame relay switch 120 includes a time division multiplex interface 122 coupled to an asynchronous transfer mode fabric 124. A Simple Network Management Protocol (SNMP) agent 126 is coupled to both time division multiplex ports 122 and asynchronous transfer mode fabric 124. Asynchronous transfer mode fabric 124 interfaces with frame relay and asynchronous transfer mode networks 132, and is operable to relay T3 and OC3 data traffic. An element manager (EM) 128 controls and performs service provisioning for frame relay switch 120. Element manager 128 is coupled to frame relay and asynchronous transfer mode network management system 130. Constructed and operating in this manner, multiple management systems are used and coordination between the management systems and the control and management of the time division multiplex and frame relay and asynchronous transfer mode networks is difficult and must be done manually. Because the management systems are not coordinated, with one managing the frame relay/asynchronous transfer mode logical plane and one managing the time division multiplex physical plane. Therefore, service provisioning is slow and cannot be automated. The result is high operation and support costs.



US006393472B1

(12) **United States Patent**
Anerousis et al.

(10) **Patent No.:** **US 6,393,472 B1**
(45) **Date of Patent:** **May 21, 2002**

(54) **AUTOMATIC AGGREGATION OF
NETWORK MANAGEMENT INFORMATION
IN SPATIAL, TEMPORAL AND
FUNCTIONAL FORMS**

(75) Inventors: Nikolaos Anerousis, New York, NY
(US); Alexandros Biliris, Chatham, NJ
(US); Hosagrahar Visvesvaraya
Jagadish, Ann Arbor, MI (US)

(73) Assignee: AT&T Corp., New York, NY (US)

(*) Notice: Subject to any disclaimer, the term of this
patent is extended or adjusted under 35
U.S.C. 154(b) by 0 days.

(21) Appl. No.: 09/207,975

(22) Filed: Dec. 9, 1998

Related U.S. Application Data

(60) Provisional application No. 60/069,007, filed on Dec. 10,
1997, and provisional application No. 60/069,024, filed on
Dec. 10, 1997.

(51) Int. Cl.⁷ G06F 15/173

(52) U.S. Cl. 709/223; 709/222; 709/228

(58) Field of Search 709/220, 221,
709/222, 223, 224, 200, 219, 203; 370/392,
258

(56) **References Cited**

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Primary Examiner—David Wiley

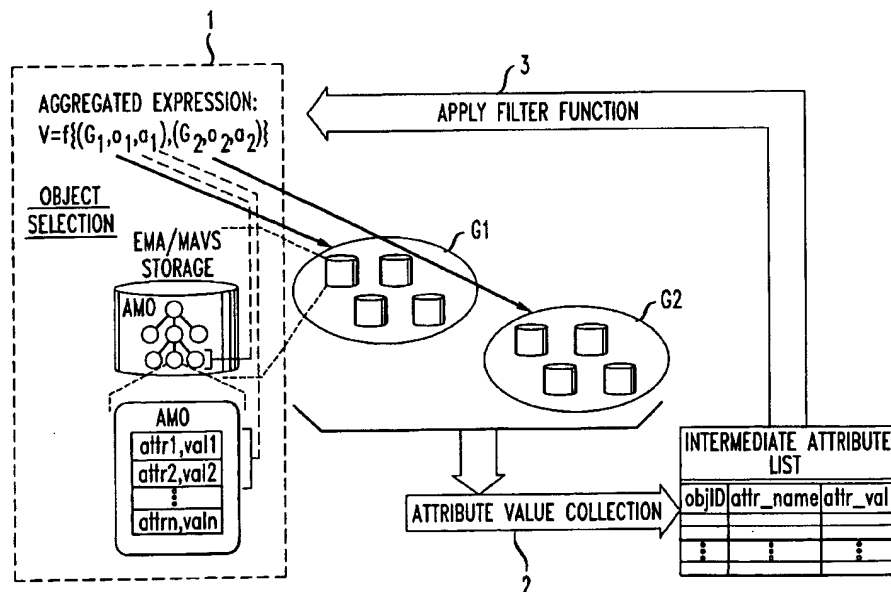
Assistant Examiner—Khanh Quang Dinh

(57)

ABSTRACT

A method and apparatus provide for the automatic aggregation of network management information in spatial, temporal and functional forms. Management information relating to a network is automatically aggregated by computational means in the form of a attribute name-value pair which is stored in an Aggregation Managed Object (AMO). The aggregation of network management information in the form of an AMO supports the spatial, temporal and functional aggregations. The AMOs themselves are stored in a database of a special management agent, the Management Aggregation and Visualization Server (MAVS) which allows network managers to access and set network information to and from the different aggregation forms.

28 Claims, 6 Drawing Sheets



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L14: Entry 2 of 14

File: USPT

May 21, 2002

DOCUMENT-IDENTIFIER: US 6393472 B1

TITLE: Automatic aggregation of network management information in spatial, temporal and functional forms

Brief Summary Paragraph Right (7):

The first generation of network management tools to face the challenge of the large numbers of network elements (scalability), such as HP Openview, Sun Net Manager, IBM Netview, etc., follow closely the point-to-point management model. According to this model, a network management application (NM client) connects to a management agent (NM server) using one of the standard protocols for management such as SNMP or CMIP. The agent contains information about a network element or a group of elements. A network manager retrieves or controls this information by issuing "get" and "set" operations. Especially in SNMP systems that do not support rich data types, this exchange of management information is at a very low level. As a result, all the intelligence for providing more complex NM services resides within the client (manager). First generation tools are therefore characterized by complex and expensive clients. Although these clients have the capability to maintain a hierarchical topology map and thereby provide easier navigation through a possibly large network, the manager still has to employ a low level management protocol to interact with every network element. First generation systems offer few capabilities to customize the available management services beyond the functionality offered by the underlying NM protocol such as SNMP or CMIP, or the interface provided by a vendor supplied element management system.



US006363421B2

(12) **United States Patent**
Barker et al.

(10) **Patent No.:** **US 6,363,421 B2**
(45) **Date of Patent:** **Mar. 26, 2002**

(54) **METHOD FOR COMPUTER INTERNET
REMOTE MANAGEMENT OF A
TELECOMMUNICATION NETWORK
ELEMENT**

5,742,762 A * 4/1998 Scholl et al. 395/200
5,812,529 A * 9/1998 Czarnik et al. 370/245
5,887,139 A * 3/1999 Madison, Jr. et al. 395/200
6,018,625 A * 1/2000 Hayball et al. 395/500
6,182,157 B1 * 1/2001 Schlener et al. 709/318

(75) Inventors: **William E. Barker**, Geneva; **Lisa M. Connelly**, Lisle; **Marvin A. Eggert**, Aurora; **Michael P. Foley**, Elmwood Park; **Kenneth R. Macfarlane**, Wheaton; **Philip M. Parsons**, Lisle; **Girish Rai**; **Jerome E. Rog**, both of Bartlett; **Kurt A. Vangness**, Aurora, all of IL (US)

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William Stallings, *SNMP, SNMPv2, and RMON Practical Network Management*, 78-80, 241-251, 262-263, Nov. 1997.*

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(73) Assignee: **Lucent Technologies, Inc.**, Murray Hill, NJ (US)

Primary Examiner—Mark H. Rinehart
Assistant Examiner—Paul Kang

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(57) ABSTRACT

In accordance with the invention, a method is provided for remotely managing a plurality of network element of a telecommunications network through a special communication link including a computer internet such as a local area network, the world wide web or the Internet. A management computer is connected to an element management system server through a communication link including the computer internet. At least one of the plurality of network elements is also coupled to the element management server through the computer internet and the at least one of the plurality of network elements is managed via communications conveyed through the element management server between the management computer and the at least one network element.

(21) Appl. No.: **09/088,463**

(22) Filed: **May 31, 1998**

(51) **Int. Cl.**⁷ **G06F 15/16; G06F 15/173**

(52) **U.S. Cl.** **709/223; 709/202; 709/224; 709/232; 709/235**

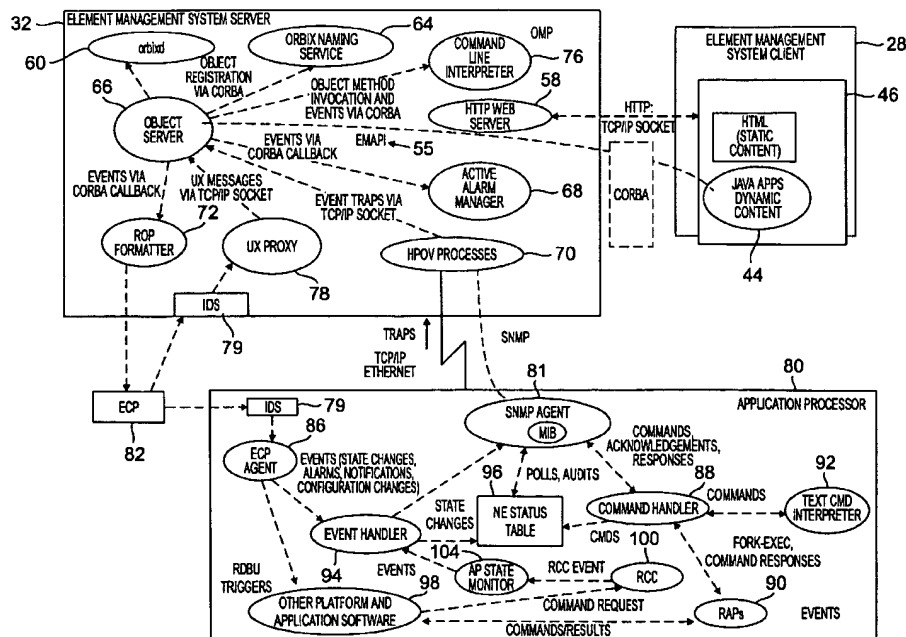
(58) **Field of Search** **709/224, 200, 709/250, 223, 318, 232, 235, 202; 370/245**

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U.S. PATENT DOCUMENTS

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28 Claims, 23 Drawing Sheets



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L14: Entry 3 of 14

File: USPT

Mar 26, 2002

DOCUMENT-IDENTIFIER: US 6363421 B1

TITLE: Method for computer internet remote management of a telecommunication network element

Detailed Description Paragraph Right (142):

The element management system interfaces to the AP via the SNMP Agent. A MIB is used to define the interface between the element management system Server and the Agent and is common to both the element management system Server and the Agent. The Agent is described here and the MIB is described in the following section. The Agent communicates with the element management system Server using the Internet standard Simple Network Management Protocol (SNMP) (see Internet document RFC-1157) via a standard UDP/IP port. In this architecture, the intent is to use SNMPv2c, which provides enhanced capabilities over SNMPv1, such as the GETBULK operation.

Detailed Description Paragraph Table (1):

APPENDIX A DEFINITION OF TERMS Alarm A condition, usually of an unexpected nature, which requires special and persistent technician notification. Active Alarm A JAVA applet displaying the current active alarms in List Browser the system for all managed objects. A sample Active Alarm List Browser Applet can be found Applet in Attachment 2 on the Alarms Web Page. ASN.1 Abstract Syntax Notation One: A formal language used to define syntax. In the case of SNMP, ASN.1 notation is used to define the format of SNMP protocol data units and of objects. AP Application Processor refers to a commercial computing system that provides generic computing facilities. APCC Application Processor Cluster Complex: the highly- available platform, or cluster computing environment, in which an AP in the cluster can run the application services of another AP in the cluster should that AP fail. AP EMS The OA&M software architecture components that reside Infrastructure on the AP to support the APCC OA&M architecture. These include the MIB on the AP, the SNMP agent on the AP, the event handler, and other components described in section 4 of this document. API Application Programming Interface: a well-defined software interface, usually abstracting the details of the underlying implementation from the client of the interface. Applet small Java program which is dynamically downloaded by a Web browser and executed by its virtual machine. Though a Java applet has access to many of the services provided by the browser execution environment (e.g. audio, network access), it is also restricted by the browser Security Manager (e.g. no access to local file system). Attribute A property of a managed object. An attribute has a value. Attribute Code A code that identifies a specific attribute of a managed object class. Class Code An integer value which uniquely identifies a managed object class. Client A function passed by the client to the server that is used Callback by the server to deliver asynchronous notifications of Function attribute changes, configuration changes or event notifications. EMAPI Element Management Application Programming Interface Event Generally, an autonomous notification. We have defined four types of events that the AP can generate: alarms, reports, state changes, configuration changes. IS-634 An international standard suite that defines the interfaces required to attach base stations from one vendor to the MSC of another vendor. IDL Interface Definition Language: A C++-like notation for describing CORBA object interfaces. IDL is used to describe any resource or service a server component wants to expose to its clients without regard to its implementation language or operating system Inheritance The conceptual mechanism by which attributes, notifications, operations, and behavior are acquired by a subclass from its superclass. Instance An integer value that identifies a specific instance of a Identifier managed object and is unique within its managed object class. JAVA An



US006282568B1

(12) **United States Patent**
Sondur et al.

(10) **Patent No.:** US 6,282,568 B1

(45) **Date of Patent:** Aug. 28, 2001

(54) **PLATFORM INDEPENDENT DISTRIBUTED MANAGEMENT SYSTEM FOR MANIPULATING MANAGED OBJECTS IN A NETWORK**

(75) Inventors: **Raghavendra Sondur**, Santa Clara;
Ping Luo, Union City, both of CA (US)

(73) Assignee: **Sun Microsystems, Inc.**, Palo Alto, CA (US)

(*) Notice: Subject to any disclaimer, the term of this patent is extended or adjusted under 35 U.S.C. 154(b) by 0 days.

(21) Appl. No.: **09/205,868**

(22) Filed: **Dec. 4, 1998**

(51) Int. Cl.⁷ **G06F 15/173; G06F 15/16**

(52) U.S. Cl. **709/223; 709/203; 370/254; 395/500; 395/712**

(58) Field of Search **709/203, 223; 714/38; 370/254; 395/500, 712**

(56) **References Cited**

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Primary Examiner—Ario Etienne

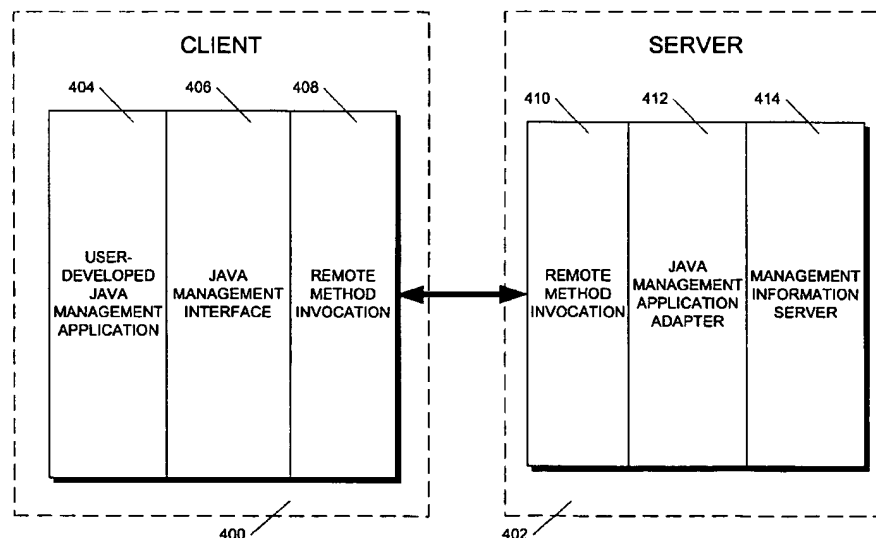
Assistant Examiner—Frantz B. Jean

(74) *Attorney, Agent, or Firm*—Kudirka & Jobse LLP

(57) **ABSTRACT**

The client portion of a distributed client-server network management system uses an interface designed with, and written in, a platform independent language, such as Java. This allows management application programs to be written in the platform independent language and insures their portability. The inventive interface caches most of the management information at the server so that only a small client program is necessary. This program can run on a system with minimal resources, thereby allowing a network manager to manage a network from virtually any location on the network. For example, the client management application could be written as a Java applet which could then be run on any Java-enabled browser. The inventive distributed management system can also connect with, and use, the services and structure of existing distributed network management systems.

21 Claims, 9 Drawing Sheets



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L14: Entry 6 of 14

File: USPT

Aug 28, 2001

DOCUMENT-IDENTIFIER: US 6282568 B1

TITLE: Platform independent distributed management system for manipulating managed objects in a network

Brief Summary Paragraph Right (5):

One such distributed network management tool is the Solstice Enterprise Manager.TM. (Solstice EM) network management system which was developed and is marketed by Sun Microsystems, Inc. This tool has an object-oriented and distributed architecture which consists of a plurality of cooperating components, including applications, libraries, information services, databases, and protocols, each of which performs specific tasks. The managed resources are arranged as a plurality of interconnected nodes and "management agents" running in each node gather information about the resources associated with the node. The information is then forwarded back to a management information server (MIS) which interacts with management applications running in other nodes. The MIS can request and change management parameter values, perform requested actions, and receive and evaluate problem reports (e.g. events, such as SNMP traps and CMIP notifications) that the management agents generate.



US006041350A

United States Patent [19] Takimoto

[11] Patent Number: 6,041,350
[45] Date of Patent: Mar. 21, 2000

[54] NETWORK MANAGEMENT SYSTEM BASED UPON MANAGED OBJECTS

FOREIGN PATENT DOCUMENTS

1194592 8/1989 Japan .

[75] Inventor: Minoru Takimoto, Kawasaki, Japan

[73] Assignee: Fujitsu Limited, Kanagawa, Japan

[21] Appl. No.: 09/039,775

[22] Filed: Mar. 16, 1998

[30] Foreign Application Priority Data

Oct. 20, 1997 [JP] Japan 9-287100

[51] Int. Cl.⁷ G06F 15/16

[52] U.S. Cl. 709/223; 709/224

[58] Field of Search 709/223, 224,
709/248; 710/17, 18; 714/39, 47, 51; 707/103,
104, 102, 1; 370/350

[56] References Cited

U.S. PATENT DOCUMENTS

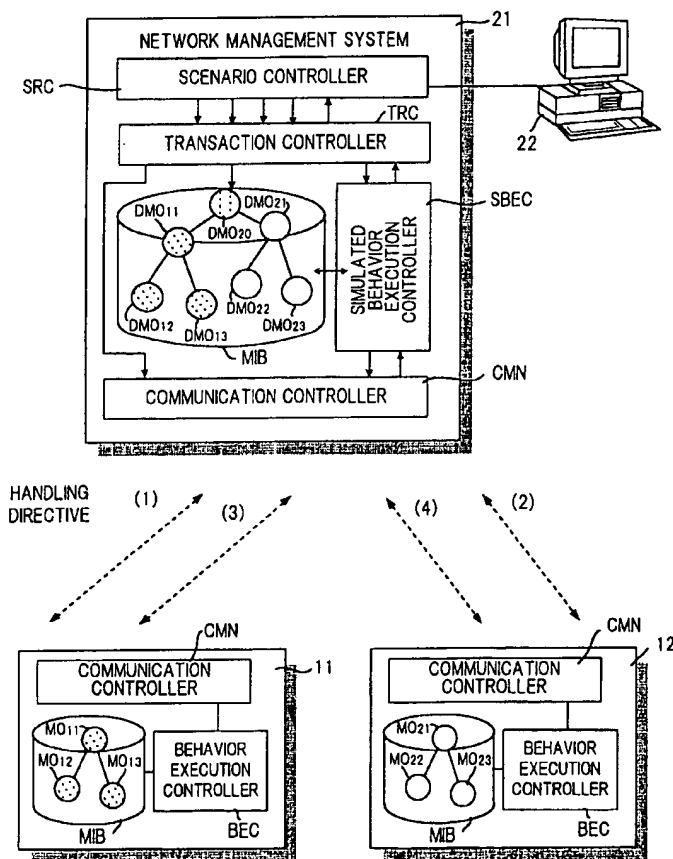
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Primary Examiner—Mehmet B. Geckil
Attorney, Agent, or Firm—Helfgott & Karas, PC

[57] ABSTRACT

Duplicates (duplicate managed objects) of managed objects that have been generated by a network element management system in order to manage the states of a plurality of network resources are produced and stored in a management information database of a network management system. Before transmitting a series of handling directives regarding a managed object generated by a network management request from a user terminal or service management system, to the network element management system, the network management system simulates the handling directives using the duplicate managed objects and notifies the source of the request of the results of simulated behavior. The network management system transmits the series of handling directives to the network element management system when the simulated behavior ends normally but does so when the simulated behavior ends abnormally.

7 Claims, 10 Drawing Sheets



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L14: Entry 12 of 14

File: USPT

Mar 21, 2000

DOCUMENT-IDENTIFIER: US 6041350 A

TITLE: Network management system based upon managed objects

Brief Summary Paragraph Right (3):

According to the prior art, such a network management system has a manager-agent architecture stipulated by the ISO and manages network elements or networks while transmitting handling directives to managed objects in the network element management system using a prescribed management protocol, e.g., a CMIP (Common Management Information Protocol).

Detailed Description Paragraph Right (21):

Though network elements and the service management system are not illustrated in FIG. 1, the overall system has the network hierarchy shown in FIG. 8, the higher and lower layers have the manager--agent relationships shown in FIG. 9, and the layers communicate via the communication protocol CMIP. More specifically, the network management system 21 and the network element management systems 11, 12 having a manager (M)--agent (A) relationship and management of the network elements is carried out by performing communication using the communication protocol CMIP.

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